

REMARKS

Reconsideration is respectfully requested in view of Applicants' amendments and remarks herein and 1.132 Declaration.

Applicants again confirm their election of Group I, now claims 2-3, 6-7, 10-12 and 18, and election of the species as indicated by the Examiner. Applicants understand that the restriction has now been made final.

Prior to considering the Office Action in detail, the Examiner is respectfully requested to note certain amendments to the claims. In this regard, throughout the claims the terminology "carboxyl group" has been changed to --carboxylic acid group-- for clarity. In addition, generic claim 2 recites that the carboxylic acid group as above noted is present at both ends of a trunk chain of the claimed fluorine-containing rubber composition as a crosslinkable group. Dependent claim 3 is now directed to the inclusion of a carboxylic acid group at an end of a branched chain as a crosslinkable group.

In Paragraphs 5 to 10 at pages 3-4 of the Office Action, claims 2, 3, 6, 7, 10-12, and 18 were rejected under 35 U.S.C. § 112, second paragraph, as follows:

- (i) Claims 2 and 3 are said to be inconsistent because cross-linking requires the presence of more than one carboxyl group. Additionally, the Examiner suggests use of the indefinite article "a" to express carboxyl group in the singular.
- (ii) Claim 6 is considered to be inconsistent with language that the Examiner understands to limit the claims to the presence of 1 carboxyl group. The Examiner further notes that Y, Y¹ and Y² are divalent groups and therefore cannot

be a carboxyl group, and further requests Applicants to substitute “is optionally” for “may be”, and to employ the indefinite article “a”.

- (iii) Claim 10 is said to be indefinite for the same reasons as claim 6, except that it does not specify that any one of Y, Y¹ and Y² is a carboxyl group.
- (iv) Claims 12 and 18 are said to be indefinite as containing more than a single sentence.
- (v) Claims 12 and 18 are said to be further indefinite because it is unclear what is meant by the expression “associated” versus “non-associated” absorption peaks. Additionally, the Examiner requests amendment of these claims to incorporate specific values for Dp and Fp.

Each of the points (i) through (iv) of the Examiner has been taken into account in amending the claims. Accordingly, these points are now obviated. As noted above, the claims now recite that a carboxylic acid group is present at both ends of a trunk chain.

With respect to point (v) as noted above, reconsideration is respectfully requested, in part. The specific values for Dp and Fp have been inserted into claims 12 and 18. The remaining issue is with respect to the expressions “associated” and “non-associated”. Applicants must respectfully submit that these terms are well known to the skilled artisan.

The submitted term “associated” means the condition where COOH groups are bonded through hydrogen bonds. When the associated COOH is measured by IR, an absorption band of COOH is shifted. Therefore, in order to determine all COOH absorptions by IR, it is not enough to observe an absorption of non-associated COOH (not associated COOH). Therefore, according

to the applicant's invention, the total absorptions of the associated and non-associated COOH is taken into account. It is submitted that the usage "non-associated" is conventional in the chemical field together with "associated".

In view of the amendments herein and above comments, Applicants respectfully request reconsideration and withdrawal of the 35 U.S.C. §112 second paragraph rejection.

In Paragraphs 14-16, claims 2, 3, 6, 7, 10-12 and 18 were rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,877,264 to Logothetis et al, optionally in view of U.S. Patent 4,743,658 to Imbalzano et al. Logothetis et al was cited as disclosing perfluoroelastomer compositions containing a plurality of carboxyl-end-groups having an integrated absorbance ratio of greater than 0.1 (column 1, line 55-column 2, line 12). Although acknowledging that Logothetis et al only exemplifies copolymer preparation under buffered conditions such that the carboxyl groups would end-up as carboxylate groups, Logothetis et al is said to specifically teach carboxyl groups (as opposed to carboxylate groups), and furthermore, that one of ordinary skill would readily envisage making the copolymer under conditions which do not result in carboxyl groups being neutralized to a salt form. Imbalzano et al was cited as teaching that the carboxyl group (-COOH) copolymers taught by Logothetis et al can be made in aqueous persulfate polymerization in the absence of buffers.

The present claims are both novel and unobvious over the cited references alone or in combination. Applicants advise that the carboxylic acid end group described in Logothetis is at most present at one chain end and almost all of such carboxylic acid groups are converted to salt.

(1)

Thus, the applicant's invention having two carboxylic acid end groups is not described nor suggested in Logothesis.

Logothesis describes that carboxyl or carboxylate endgroups can result from hydrolysis of polymer endgroups produced through persulfate initiation. The hydrolyzed polymer ends exist as carboxylate salts of the metals and other cations present in the polymerization mixture (column 5, lines 33-7). Namely, even if ammonium persulfate is used as a polymerization initiator, according to Logothesis the resulting polymer has the carboxylate salt of metal, not a carboxylic acid group.

In addition, Logothesis says that "A potential problem exists for polymer composition of the present invention wherein the perfluoroelastomer component has carboxyl or carboxylate endgroups. The viscosity of these polymers is higher than that of polymers of the same molecular weight having no ionizable carboxyl endgroups, or carboxylate endgroups.... This problem can be remedied by heating to decarboxylate a portion of the endgroups and convert them to non-ionizable substituents..." (column 7, lines 10-20). These descriptions teach that the non-ionizable endgroup is preferred and to reduce ionizable endgroups such as carboxyl and carboxylate endgroups.

In Logothesis since an integrated absorbance of carbonyl-containing endgroups is measured, the absorbance of the carboxylic acid endgroup is not specified. Namely, according to Logothesis, the total absorbance of carbonyl-containing end groups selected from the group consisting of carboxyl endgroups, carboxylate endgroups, carboxamide endgroup and mixture thereof is essentially important, but the total amount of associated and non-associated carboxylic

acid end groups is not focused upon. The carboxylic acid end group in Logothesis if contained, ^{N^o} has to be decarboxylated, and does not have a role for crosslinking.

In Logothesis Example 1, the polymerized polymer is coagulated from the reaction mixture by using as a metal salt, magnesium sulfate to convert the acid to carboxylic acid metal salt (column 11, lines 18-22). This procedure is reasonable within the context of of Logothesis, because according to Logothesis “carbonyl-containing end group”, not “carboxylic acid end group” is essential and is what is measured. [?]

It is common knowledge in the art that carboxylic acid disappears by coagulation with metal salt. This is pointed out in the applicant’s specification (page 39, lines 7-11). A 1.132 Declaration to confirm this fact is submitted herewith. [?]

The resultant product of coagulation no longer contained a cross-linkable carboxylic acid group.

In partial summary, as shown by the Logothesis Example 1, and others, Logothesis is interested in carbonyl and not carboxylic acid groups. Even so, were one to accept the entire prior art position set forth in the Office Action, still Applicant’s claims are novel and unobvious over Logothesis at least for the reason of having a carboxylic acid group present at both ends of a trunk chain.

The Examiner cites Imbalzano as a second citation for showing that when APS is used as a polymerization initiator, the end group of the polymer is COOH. However, since there is no teaching in Logothesis to convert the end group into COOH, but decarboxylation is recommended, there is no motivation to combine Imbalzano with Logothesis. In fact, the skilled

artisan would not consider such a combination, especially in view of the example 1 salt conversion of Logothesis. The claims are clearly patentable over the combination of references.

In Paragraphs 17-20 at pages 5-6 of the Office Action, claims 2, 3, 6, 7, 10 and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,726,214 to Buckmaster et al, U.S. Patent 3,674,758 to Carlson or U.S. Patent 5,180,803 to Gibbard. Each of these references was cited as disclosing various fluorine-containing polymers in which carboxyl or carboxylic acid end groups thereof have been decarboxylated or converted to methyl esters. The Examiner considered that the starting materials would anticipate the rejected claims.

Applicants' claims are directed to a fluorine-containing rubber composition which comprises a fluorine-containing elastomer having a cross-linkable carboxylic acid group present at both ends of a trunk chain thereof. In other words, Applicants are not claiming any fluorine-containing polymer which may have a carboxylic acid group at an end portion thereof, but a fluoroine-containing elastomer wherein the carboxylic acid groups are cross-linkable.

The cited references of Buckmaster, Carlson or Gibbard have been carefully reviewed by the Applicants and Applicants advise that none of these references disclose a fluorine-containing elastomer having cross-linkable carboxylic groups. As a result, Applicants' claims are clearly novel over each of the references. Each of the cited references is directed to a melt-fabricable fluoropolymer. These melt-fabricable resins or polymers are not cross-linkable elastomers in accordance with Applicants' claims.

For example, with respect to Buckmaster, see the Summary of the Invention beginning at column 1, line 48, and Example 1, describing the melt-fabricable perfluoropolymers set forth

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therein. With respect to Carson, see for example column 2, line 65,66 with respect to melt-fabrication of the polymers. Reference can also be made to claim 1 with respect to the same language. As to the final reference of Gibbard, see for example, column 7, paragraph beginning at line 32, the paragraph immediately thereafter and claim 1 directed to a production of a melt-fabricable fluoropolymer.

In summary, with respect to the references applied in paragraphs 18 through 20, Applicants must earnestly submit that fluorine-containing elastomers are not being described. Accordingly, Applicants' claims are novel over each of the references.

In Paragraphs 21-22 of the Office Action, claims 12 and 18 were rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Buckmaster et al, Carlson or Gibbard. The Examiner considered that the (starting) fluorine-containing polymers disclosed therein would inherently have an integrated absorbance ratio falling within the scope of claims 12 and 18.

Claims 12 and 18 are allowable for the same reasons why the remaining claims are allowable over the same references. Accordingly, this rejection should be reconsidered and withdrawn.

Early indication of allowance is respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

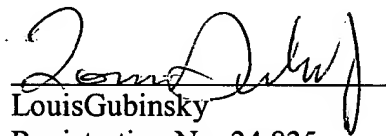
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Date: June 20, 2003

APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE

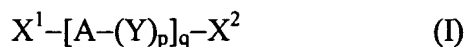
IN THE CLAIMS:

The claims are amended as follows:

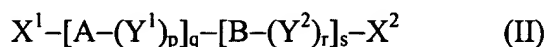
2. (Twice Amended) A fluorine-containing rubber composition for crosslinking, which comprises a fluorine-containing elastomer having ~~carboxyl group~~ a carboxylic acid group present at both ends ~~an end~~ of a trunk chain ~~and/or branched chain~~ as a crosslinkable group.

3. (Amended) The fluorine-containing rubber composition for crosslinking of Claim 2, wherein ~~which comprises a~~ the fluorine-containing elastomer has ~~having~~ carboxyl a carboxylic acid group at an end of a branched chain as a crosslinkable group.

6. (Twice Amended) The fluorine-containing rubber composition for crosslinking of Claim 2, wherein the fluorine-containing elastomer has a carboxylic acid group ~~carboxyl group~~ at ~~an end~~ both ends of a trunk chain ~~and/or branched chain~~ as a crosslinkable group and is represented by the formula (I):



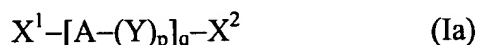
or the formula (II):



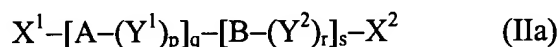
wherein X^1 and X^2 are ~~the same or different and each is~~ both a carboxylic acid ~~carboxyl group, alkoxycarbonyl group, iodine atom, bromine atom or sulfonic acid group~~, Y , Y^1 and Y^2 are the same or different and each is a divalent organic group having a carboxylic acid ~~carboxyl group~~,

an alkoxy carbonyl group, an iodine atom or, a bromine atom ~~or nitrile group~~ at a side chain thereof, A is an elastomeric fluorine-containing polymer chain segment, B is a non-elastomeric fluorine-containing polymer chain segment, p is 0 or an integer of 1 to 10, q is an integer of 1 to 5, r is 0 or an integer of 1 to 10, s is an integer of 1 to 3, ~~any one of X¹, X², Y, Y¹ and Y² is~~ carboxyl group, at least one of Y¹ and Y² is a divalent organic group having a carboxylic acid group, and Y, Y¹ and Y² may be is optionally contained at random in the segment A or B.

10. (Amended) A fluorine-containing elastomer which has a carboxylic acid-carboxyl group at an end of a trunk chain as a crosslinkable group and is represented by the formula (Ia):



or the formula (IIa):



wherein X¹ and X² are ~~the same or different and each is~~ both a carboxylic acid-carboxyl group, alkoxy carbonyl group, iodine atom, bromine atom or sulfonic acid group Y, Y¹ and Y² are the same or different and each is a divalent organic group having a carboxylic acid-carboxyl group, an alkoxy carbonyl group, an iodine atom or, a bromine atom ~~or nitrile group~~ at a side chain thereof, A is an elastomeric fluorine-containing polymer chain segment, B is a non-elastomeric fluorine-containing polymer chain segment, p is 0 or an integer of 1 to 10, q is an integer of 1 to 5, r is 0 or an integer of 1 to 10, s is an integer of 1 to 3, ~~any one of X¹, X², Y, Y¹ and Y² is~~ carboxyl group, at least one of Y¹ and Y² is a divalent organic group having a carboxylic acid group, and Y, Y¹ and Y² may be is optionally contained at random in the segment A or B.

12. (Twice Amended) The fluorine-containing elastomer of Claim 10, which satisfies the following equation (1):

$$\frac{(S_{co}/S_{cf}) \times (D/D_p) \times (F/F_p)}{0.01} \geq 1 \quad (1)$$

$$\frac{(S_{co}/S_{cf}) \times (D/2.03) \times (F/71.6)}{0.01} \geq 1 \quad (1)$$

wherein S_{co} , S_{cf} , D , D_p , and F and F_p represent the following respective values;

S_{co} : Total area of absorbances at the absorptions derived from carbonyl group of associated and non-associated carboxyl groups having the absorption peaks at from 1,680 to 1,830 cm^{-1} when measurement is made with FT-IR with respect to the elastomer to be measured;

S_{cf} : Area of absorbance at absorption derived from a harmonic sound of C-F bond having an absorption peak at from 2,220 to 2,840 cm^{-1} when measurement is made with FT-IR with respect to the elastomer to be measured. ~~In, and in the~~ case where nitrile group is present, S_{cf} is a value obtained by subtracting an area of absorbance at absorption derived from nitrile group having an absorption peak at from 2,220 to 2,300 cm^{-1} from a total area of absorbances at whole absorption having a peak at from 2,220 to 2,840 cm^{-1} ;

D : Specific gravity of the aimed elastomer at 20°C; and

~~D_p : Specific gravity (measured value: 2.03) at 20°C of a standard perfluoro elastomer (copolymer of tetrafluoroethylene/perfluoro(methyl vinyl ether) in a mole ratio of 58/42).~~

F : Fluorine content (% by weight) of the elastomer to be measured obtained by elemental analysis.

~~Fp: Fluorine content (measured value: 71.6 % by weight) of said standard perfluoro elastomer obtained by elemental analysis.~~

18. (Amended) The fluorine-containing elastomer of Claim 11, which satisfies the following equation (1):

$$\frac{(S_{co}/S_{cf}) \times (D/D_p) \times (F/F_p)}{0.01} \leq 1 \quad (1)$$

$$\frac{(S_{co}/S_{cf}) \times (D/2.03) \times (F/71.6)}{0.01} \leq 1 \quad (1)$$

wherein S_{co} , S_{cf} , D , ~~D_p~~ , and F ~~and F_p~~ represent the following respective values;

S_{co} : Total area of absorbances at the absorptions derived from carbonyl group of associated and non-associated carboxyl groups having the absorption peaks at from 1,680 to 1,830 cm^{-1} when measurement is made with FT-IR with respect to the elastomer to be measured;

S_{cf} : Area of absorbance at absorption derived from a harmonic sound of C-F bond having an absorption peak at from 2,220 to 2,840 cm^{-1} when measurement is made with FT-IR with respect to the elastomer to be measured ~~—In , and in the~~ case where nitrile group is present, S_{cf} is a value obtained by subtracting an area of absorbance at absorption derived from nitrile group having an absorption peak at from 2,220 to 2,300 cm^{-1} from a total area of absorbances at whole absorption having a peak at from 2,220 to 2,840 cm^{-1} ;

D : Specific gravity of the aimed elastomer at 20°C; and

~~D_p : Specific gravity (measured value: 2.03) at 20°C of a standard perfluoro elastomer (copolymer of tetrafluoroethylene/perfluoro(methyl vinyl ether) in a mole ratio of 58/42).~~

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F: Fluorine content (% by weight) of the elastomer to be measured obtained by elemental analysis.

~~F_p: Fluorine content (measured value: 71.6 % by weight) of said standard perfluoro elastomer obtained by elemental analysis.~~